In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

No. 20-1716V

A.T., Natural Mother and Guardian for G.T., a minor, Petitioner, v. SECRETARY OF HEALTH AND HUMAN SERVICES, Respondent.	Chief Special Master Corcoran Filed: April 24, 2024

Carol Gallagher, Carol L. Gallagher Esquire LLC, Somers Point, NJ, for Petitioner.

Lauren Kells, U.S. Department of Justice, Washington, DC, for Respondent.

ENTITLEMENT DECISION[1]

On December 1, 2020, A.T. filed a petition for compensation under the National Vaccine Injury Compensation Program (the "Program").[2] Petition (ECF No. 1) at 1. Petitioner alleges that her son, G.T., was neurologically harmed by a pneumococcal vaccine administered to him on January 28, 2019. *Id.* The parties have submitted briefs for resolution of the matter via ruling on the record. *See* Respondent's Motion, dated August 2, 2023 (ECF No. 54) ("Mot."); Petitioner's Brief in Opposition, dated September 5, 2023 (ECF No. 55) ("Opp."); Respondent's Reply, dated September 19, 2023 (ECF No. 56) ("Reply"). For the reasons set forth below, and based on the parties' filings and the record, I hereby deny entitlement.

[1] Under Vaccine Rule 18(b), each party has fourteen (14) days within which to request redaction "of any information furnished by that party: (1) that is a trade secret or commercial or financial in substance and is privileged or confidential; or (2) that includes medical files or similar files, the disclosure of which would constitute a clearly unwarranted invasion of privacy." Vaccine Rule 18(b). Otherwise, the whole Decision will be available to the public in its present form. *Id.*

[2] The Vaccine Program comprises Part 2 of the National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3758, codified as amended at 42 U.S.C. §§ 300aa-10 through 34 (2012) [hereinafter "Vaccine Act" or "the Act"]. Individual section references hereafter will be to § 300aa of the Act (but will omit that statutory prefix).

I. Factual Background

G.T. was three years old at the time of the vaccination at issue. He had previously received several vaccines without complication—including the pneumococcal vaccine on three prior occasions (in February 2016, April 2016, and June 2016, respectively). Ex. 6 at 14, 35, and 72. His pre-vaccination medical history includes torticollis and plagiocephaly[3], but was otherwise largely normal—including his development—beyond concerns for obesity. *Id.* at 60, 67. G.T. received his fourth dose of the pneumococcal vaccine (the one at issue in this case) on January 28, 2019. *Id.* at 69.

Seven days later, on February 4, 2019, G.T. was brought back to the pediatrician with complaints of "jerking body," twitching, and eye twitching, as well as diarrhea "for [a] few days after Prevnar vaccination." Ex. 6 at 70. His physical examination was normal, although some vaccination situs redness/irritation was reported. *Id*. The pediatrician diagnosed a tic disorder and ordered laboratory testing. *Id.* Although the record is devoid of additional details specific to this treatment event, Petitioner maintains that *the day after* vaccination, G.T. had displayed "excessive eye blinking, which I did not know at the time were focal seizures. He also had random full body twitching and walking very clumsy," and that by the third day post-vaccination was manifesting "twitching, excessive eye blinking, and was zoning out." Affidavit of A.T., filed as Ex. 2 (ECF No. 7-2), at 1. Then, in the subsequent days leading up to the February 4th pediatric visit, G.T. displayed "seizure-like movements, zoning out, excessive eye blinking, tics, and muscle spasms and the symptoms became consistent." *Id.*

Petitioner brought G.T. the next day to a second pediatrician, Anil Pawa, M.D. Ex. 7 at 5. Dr. Pawa was informed that G.T. had been twitching and "zoning out since Tuesday last week" - the day after his receipt of the fourth pneumococcal vaccine dose. *Id.* Onset of these symptoms had been observed by Petitioner to be accompanied by a swollen/red ear, although she had been informed this was a common vaccine reaction. *Id.* The exam performed by Dr. Pawa yielded normal results, but after Petitioner showed video recorded evidence of G.T. engaging in the movements she had reported, Dr. Pawa referred her to a hospital emergency room for an electroencephalography ("EEG") study to rule out seizures. *Id*. at 7.

G.T. thereafter underwent a 48-hour EEG (from February 5-7, 2019), at Jersey Shore University Medical Center. Ex. 8 at 129. Petitioner's reported history was consistent with what she had previously told pediatricians, but she added that by January 30th (two days post-vaccination), G.T. had begun to have intermittent, five to seven-second episodes of eye blinking and twitches. *Id.* G.T.'s exam again was deemed normal, and the attending neurologist expressed doubt that G.T. was experiencing seizures. *Id*. at 130, 138, 150-51 and 182. However, the EEG indicated "sharp wave activity" in his left parietal central head region, albeit without clinical correlation. *Id*. at 159. G.T. again saw Dr. Pawa a few days later, and although Petitioner expressed the new concern that G.T. was having trouble walking, an exam revealed no concerns, and G.T. was at this time diagnosed with an ear infection. Ex. 7 at 9.

[3] Plagiocephaly is "an asymmetric condition of the head, resulting from irregular closure of the cranial sutures." Plagiocephaly, *Dorland's Medical Dictionary Online*, https://www.dorlandsonline.com/dorland/definition?id=39405&searchterm=plagiocephaly (last accessed March 25, 2024).

Attempts to Explain G.T.'s Presentation

Petitioner brought G.T. back to Dr. Pawa on February 13, 2019. Ex. 7 at 13. Petitioner now reported that G.T.'s tics had started to improve after two doses of antibiotics, and had eventually disappeared completely. *Id.* And although G.T.'s ear pain had subsided, he still had some nasal congestion. *Id*. Dr. Pawa opined that G.T. might be suffering from pediatric autoimmune neuropsychiatric disorder associated with streptococcus, or "PANDAS," and that this might be the cause of G.T.'s tics. *Id.* at 15. To assess whether this explained his symptoms, it was proposed that G.T. be tested for streptococcal antibodies, plus (at Petitioner's request) undergo genetic testing to reveal whether he possessed an MTHFR mutation.[4] *Id*. Although the results indicated a "[s]ingle mutation for MTHFR," Dr. Pawa interpreted the results to be normal (including strep antibody ranges) *Id.* at 42. Almost two weeks later, G.T. had a pediatric sick visit due to fever, vomiting, and ear pain. *Id.* at 18. His rapid streptococcal test was now positive. *Id*. at 20.

In further pursuit of the possibility that G.T. had PANDAS, Petitioner consulted in early March 2019 with an infectious disease specialist, Aswine Bal, M.D. Ex. 9 at 10. Dr. Bal noted that G.T.'s history included frequent upper respiratory infections and ear infections, and that he had begun to engage in aberrant movements, and display seizure-like tic behaviors, within two days of vaccination. *Id*. at 12. (It was also noted at this time, however, that since he had turned two in November 2017—over a year prior to vaccination—G.T. had displayed behavioral issues, aggressive behaviors, and tantrums). *Id*. at 11. G.T.'s examination was again normal, and Dr. Bal stated that G.T. "[did] not have any obsessive-compulsive behavior" that would be characteristic of PANDAS. *Id.*

That same month, G.T. saw a pediatric neurologist, Roopal Karia, M.D. Ex. 7 at 57. G.T.'s examination was normal, although Dr. Karia noted that G.T.'s prior EEG was abnormal during sleep, with sharp waves mostly in the left hemisphere of the brain. *Id*. at 59. He was also taken that month to see a pediatric allergist and immunologist, Thu Aung, M.D. Ex. 12 at 5. Dr. Aung ordered a workup for PANDAS, based on the preliminary view (relying in turn on the reported history) that G.T.'s condition "sounds like PANDA [sic] symptoms," but Dr. Aung also deemed it "less likely to be caused from PREvenor [sic] vaccine." *Id.* An immunoglobulin E antibody test performed at this time was unremarkable. *Id*. at 9.

G.T. continued to experience recurrent streptococcal infections into April (and even thereafter), returning to Dr. Bal on April 11, 2019, for more evaluation. Ex. 9 at 6. An exam revealed some evidence

[4] The MTHFR gene mutation is "a common autosomal recessive, inborn, error of folate metabolism caused by mutation in the MTHFR gene...which encodes the enzyme....Clinical manifestations, age of onset, and severity are highly variable, characteristics include signs of neurologic damage, ranging from psychiatric symptoms to fatal developmental delay, microcephaly, ectopia lentis, and thrombosis. Some patients are asymptomatic." *Dorland's Illustrated Medical Dictionary* 1136 (33d ed. 2020) (hereinafter "Dorland's"). The MTHFR gene has been implicated in causation theories in past Program cases, although such theories have more often than not been deemed unreliable. *See Murphy v. Sec'y of Health & Hum. Servs.*, No. 05-1063V, 2016 WL 3034047, at n66 (Fed. Cl. Spec. Mstr. Apr. 25, 2016) (discussing repeated rejection of MTHFR-based theories in Program cases).

of prior ear infections and associated irritation, but neurological exam results were deemed "grossly normal." *Id*. Dr. Bal noted that G.T.'s prior treatment with antibiotics had seemed to resolve some of his prior tic-like behavior, so he prescribed a ten-day course of amoxicillin to see whether it would work again—and thus whether treatment with an "antibiotic prophylaxis" for period of time going forward would be beneficial as well, to the extent G.T. in fact had PANDAS. *Id.* G.T. also at this time had a consultation with a pediatric geneticist (given Petitioner's previously-expressed concerns about a possible MTHFR mutation), but testing results yielded normal results, and the geneticist expressed the view that a MTHFR polymorphism was very common in the general population, and that G.T. would have displayed symptoms and tested positive for a severe neurometabolic condition had he possessed a pathologic variant. Ex. 10 at 6, 9–10.

By late May 2019, it had been determined that G.T. required surgical intervention to assist him with his persistent ENT issues/ear infections. Thus, on May 29, 2019, G.T. underwent a tympanostomy under general anesthesia, as well as a tonsillectomy and adenoidectomy. Ex. 8 at 47. He also thereafter was prophylactically prescribed antibiotics, based on the possibility that PANDAS explained his tic behaviors. Ex. 12 at 13 ("[H]is tic reactions possibly associated with strep infection, probably PANDA"). Around this time, he was also excused from further vaccinations until his clinical condition was improved (although this excuse seems more to have been occasioned by Petitioner's concerns than the product of informed treaters views that his prior receipt of the pneumococcal vaccine had caused his subsequent symptoms—as the document suggests). *Id.*

Several months later, on November 6, 2019, G.T. was taken for a return visit to his neurologist, Dr. Karia. Ex. 7 at 52. Petitioner reported that G.T. was experiencing ongoing symptoms of leg jerks, shoulder shrugging, throat clearing, head extension, and "piano fingers." *Id.* G.T.'s neurological and physical exam at this time was mostly normal, however, and G.T. was diagnosed with tics and static encephalopathy. *Id.* at 53.

Treatment in 2020

G.T. did not see Dr. Karia again until six months later, on May 28, 2020. Ex. 7 at 47. He was now reported to be experiencing eye blinking and lip smacking but no impairment of consciousness. However, a video Petitioner shared at this time with Dr. Karia was not deemed to reveal abnormal body movements or other seizure-like activity, and G.T.'s exam was again deemed normal. *Id*. at 47, 48. Dr. Karia proposed that G.T. suffered from tics, and disclaimed the expertise to diagnose PANDAS, recommending instead that a specialist be visited to evaluate whether that condition as present. *Id.*

To that end, Petitioner took G.T. to see Rosario Trifiletti, M.D., a neurologist with the PANDAS/PAN Institute, in June 2020. At this time, Dr. Trifiletti prepared a letter excusing G.T. from all vaccinations until further notice, recording therein the suspicion that there was "an underlying genetic condition explaining [G.T.'s] developmental delay," while also referencing Tourette syndrome as applicable. Ex. 13 at 3. That same month, G.T. underwent another EEG—and this time its results were interpreted as abnormal, with evidence of "intermittent right frontocentral sharp and slow wave activity

at frequencies of 1 and 2 Hz…" Ex. 13 at 10, 12. However, the technician's write-up of the results also stated that "[t]his finding is epileptiform *incompatible with but not in itself diagnostic of* a partial seizure disorder of right frontocentral onset." *Id.* (emphasis added).

In September 2020, G.T. was taken for a consultation with a different neurologist, Katherine Taub, M.D., at the Children's Hospital of Philadelphia. Ex. 15 at 39. An extensive neurological examination produced normal results, although Dr. Taub diagnosed tics, behavior difficulties, and separation anxiety. *Id*. at 43, 44. But Dr. Taub did not agree with the interpretation of G.T.'s prior EEGs, and suggested a repeat EEG be performed. *Id*. In addition, she noted that "[w]hile there is research ongoing to determine if GAS [group A streptococcal] can lead to tics or other neuropsychiatric changes, as this time our understanding is that children with baseline tic (or other) disorder may have an exacerbation during the time of an acute infection, but *acute infections are not the underlying cause of these disorders*" and therefore lengthy antibiotics courses were not necessary. *Id.* (emphasis added). Toward that middle of that same month, G.T. again received genetic testing. This time it revealed "a heterozygous variant of uncertain significance" in the histidine decarboxylase ("HDC") gene, indicating a possible genetic diagnosis of autosomal dominant Tourette syndrome. Ex. 13 at 4.

No records for treatment received after this date have been filed.

II. Expert Reports and Treater Evidence

A. *Petitioner's Experts*

Petitioner submitted three expert reports in this case. Two are from Dr. Mahbubul Huq. First Huq Report, dated April 28, 2022, filed as Ex. 18 (ECF No. 30) ("First Huq Rep.") and Supplemental Huq Report, dated January 17, 2023, filed as Ex. 108 (ECF No. 44) ("Huq Supp. Rep."). The third is from Dr. Eric Gershwin. Gershwin Report, dated April 18, 2023, filed as Ex. 48 (ECF No. 48) ("Gershwin Rep.").

1. Dr. Mahbubul Huq, M.B.B.S., Ph.D.

Dr. Huq received his medical degree from Dhaka Medical College in Bangladesh, and his Ph.D. in Medical Science from Tokushima University. Huq CV, dated April 28, 2022, filed as Ex. 19 (ECF NO. 30-2). He is a board-certified pediatric neurologist and clinical geneticist at Children's Hospital of Michigan. Huq First Rep. at 1. He is also a Professor of Pediatrics at Central Michigan University, and Professor of Neurology at Wayne State University. *Id*. He has published peer-reviewed journal articles on the genetics of Tourette syndrome, epilepsy and neurodevelopmental disorders. *Id*. In his clinical practice, he has treated thousands of patients with tics, epilepsy, and developmental delays. *Id*.

Dr. Huq raises two different theories of causation for G.T.'s tic disorder: cytokine-induced brain inflammation, and/or molecular mimicry between components of the pneumococcal vaccine and brain tissue. He theorizes that the sequence of events triggered by G.T.'s vaccination contributed significantly to the development of his tics and Tourette syndrome (which Dr. Huq's report favored as the proper diagnosis for G.T.—over seizures, PANDAS, or any other competing explanation). Huq First Rep. at 8.

Dr. Huq began his opinion with a discussion of the genetic and environmental bases for Tourette syndrome, and G.T.'s likely susceptibility to the same. Huq First Rep. at 8. Tourette syndrome is a "childhood onset neurodevelopmental disorder characterized by multiple motor tics, and at least one vocal/phonic tic, and often one or more comorbid psychiatric disorders." *Id*. The pathophysiology of the disorder involves the cortico-striato-thalamo-cortical circuits. *Id*. Although no specific etiologic explanation for Tourette syndrome has been confirmed, evidence of a genetic component is strong. *Id*. The results of twin studies also provide evidence for non-genetic factors: monozygotic twins are only concordant for Tourette syndrome half of the time, while dizygotic twins are concordant 10% of the time. *Id*. at 9.

G.T., Dr. Huq opined, was "probably a susceptible individual considering his family history and a variant of uncertain significance in the HDC gene." Huq First Report at 22. However, his written reports offered little independent support for this conclusion. He proposed, for example, that G.T.'s family history may have been contributory, but does not go into detail how. *Id*. at 7. He also pointed out the missense variant found in G.T.'s HDC gene, noting that it is classified as a "variant of uncertain significance." *Id*. at 7. However, he argued that the treater's conclusion that "[t]he genetic diagnosis of autosomal dominant Gilles de la Tourette syndrome is possible"—meaning genetics might *entirely* explain G.T.'s presentation - is "not justified or fair," given the lack of literature on the HDC variant. *Id*. at 7, Ex. 15 at 4.

Dr. Huq then offered an opinion as to how the pneumococcal vaccine could cause brain inflammation. Huq First Rep. at 9. The vaccine includes a number of polysaccharides, including cell wall polysaccharides. Id. at 9. Certain items of medical literature have found that capsular polysaccharides can trigger inflammatory cytokine release, including release of TNF-a.[5] *Id.* (citing item of literature not filed in this matter). One study in particular has associated the specific bacterial capsule polysaccharides included in the relevant pneumococcal vaccine to the production of a variety of cytokines, such as IL-8, TNF, IL-10, and IFN-γ. *Id*. at 10; M. Sundberg-Kovamees et al., *Immune Cell Activation and Cytokine Release After Stimulation of Whole Blood with Pneumococcal C-polysaccharide and Capsular Polysaccharides*, 52 International Journal of Infectious Diseases 1 (2016), filed as Ex. 96 (ECF No. 36-30). And another study had revealed the involvement of TNF-a in programing neuronal excitability both acutely and long-term, especially in peripheral inflammation. *Id.*, K. Riazi et al., *Contributions of Peripheral Inflammation to Seizure Susceptibility: Cytokines and Brain Excitability*, 89 Epilepsy Research 34 (2010), filed as Ex. 88 (ECF No. 36-22).

[5] One of the studies cited for this contention explains TNF-a and its role in the nervous system as follows: "Classical inflammatory cytokines, such as IL-1B, TNF-a, and IL-6, by activating their cognate receptors in target cells, induce intra-cellular pathways which differ depending on the cell type, and often result in divergent pathophysiologic outcomes. In the nervous system, cytokines have physiological functions that include neurite outgrowth, neurogenesis, neuronal survival, synaptic pruning during brain development, and they regulate the strength of synaptic transmission and synaptic plasticity. However, the over-production and exaggerated release of cytokines, or their protracted presence in tissue, is associated with neuronal dysfunctions, as described in neuropathic pain, psychiatric disorders, neurodegenerative diseases and epilepsy." A. Vezzani & B. Viviani, *Neuromodulatory Properties of Inflammatory Cytokines and Their Impact on Neuronal Excitability*, 96 Neuropharmacology 70, 71 (2015), filed as Exhibit 103 (ECF No. 36-37) (internal citations omitted).

All of the above suggested how the vaccine could cause harm leading to a tic disorder—even though the vaccination's immediate pro-inflammatory impact would mostly occur at the situs of vaccination. Peripheral inflammation, Dr. Huq maintained, can affect the brain in a number of ways: influencing neuronal and glial physiology, and also disrupting the blood-brain barrier. Huq First Rep. at 10. This disruption can allow additional access for systemically-circulating cytokines, with even low levels of such cytokines having been shown to affect brain function. *Id*.; D. Martino et al., *What Does Immunology Have to Do With Normal Brain Development and the Pathophysiology Underlying Tourette Syndrome and Related Neuropsychiatric Disorders?*, 11 Frontiers in Neurology 1 (2020), filed as Ex. 74 (ECF No. 36-8); T. Pollmacher et al., *Low Levels of Circulating Inflammatory Cytokines- Do They Affect Human Brain Functions?*, 16 Brain, Behavior, and Immunity 525 (2016), filed as Ex. 86 (ECF No. 36-20). There was also the fact that the aluminum adjuvant used in the vaccine, which can function as a blood-brain barrier neurotoxin. Id. at 10; W. Zheng, *Neurotoxicology of the Brain Barrier System: New Implications*, 39 Clinical Toxicology 711 (2001), field as Ex. 107 (ECF No. 36-41). Because the adjuvant can also stimulate production of inflammatory cytokines in connection with vaccination, it has the dual capacity to assist in the breach of the blood-brain barrier while also encouraging more inflammation and excitotoxicity in the brain itself. *Id*.

Dr. Huq then explained how the brain inflammation he proposed could be vaccine-stimulated might in turn result in neuronal excitability sufficient to produce seizures, or (as here) a tic disorder like Tourette syndrome. Huq First Rep. at 13. Certain medical literature, he maintained, supports a number of connections between immune-mediated inflammation and both tics and seizures. *Id.* For example, some studies show that patients with tic disorders have increased family history of autoimmune diseases, and higher levels of autoantibodies. J. Instanes et al., *Attention-Deficit/Hyperactivity Disorder in Offspring of Mothers with Inflammatory and Immune System Diseases*, 81 Biological Psychiatry 452 (2017), filed as Ex. 56 (ECF No. 34-19); D. Martino et al., *Antineuronal Antibody Status and Phenotype Analysis in Tourette's Syndrome*, 22 Movement Disorders 1424 (2007), filed as Ex. 73 (ECF No. 36-7). Children with Tourette syndrome also display lower numbers of T regulatory cells in the brain periphery (futher suggesting a propensity for an autoimmune disease). Huq First Rep. at 15; I. Kawikova et al., *Decreased Numbers of Regulatory T Cells Suggest Impaired Immune Tolerance in Children with Tourette Syndrome: A Preliminary Study*, 61 Biological Psychiatry 273 (2007), filed as Ex. 59 (ECF NO. 34-22). Other items of literature suggest that certain infections (like Group A streptococcus pharyngotonsillitis, as well as other non-streptococcal infections) may be associated with tic disorders. *Id*. at 14; F. Cardona & G. Orefici, *Group A Streptococcal Infections and Tic Disorders in an Italian Pediatric Population*, 138 The Journal of Pediatrics 71 (2001), filed as Ex. 29 (ECF No. 32-10); G. Keszler et al., *Association of the Tumor Necrosis Factor -308 A/G Promoter Polymorphism with Tourette Syndrome*, 41 International Journal of Immunogenetics 493 (2014), filed as Ex. 60 (ECF No. 34-23).

Patients with tic disorders also display higher levels of pro-inflammatory activity in the brain and brain periphery. Huq First Rep. at 14. In support, Dr. Huq referenced several studies showing increased levels of various cytokines in these patients, including TNF-a, IL-1, IL-2, IL-6, CRP, and neopterin. *Id*.; Y. Cheng et al., *Detection of Autoantibodies and Increased Concentrations of Interleukins in Plasma*

from Patients with Tourette's Syndrome, 48 Journal of Molecular Neuroscience 219 (2012), filed as Ex. 32 (ECF No. 32-13) ("Cheng"); V. Gabbay et al., *A Cytokine Study in Children and Adolescents with Tourette's Disorder*, 31 Progress in Neuro-Psychopharmacology and Biological Psychiatry 967 (2009), filed as Ex. 40 (ECF No. 34-3). And other studies have connected production of these and other cytokine pathways to microglial maturation in the brain. *Id*. at 15. Microglial maturation and dysfunction has been associated with Tourette syndrome by a number of studies. *See, for example* J. Hong et al., *Microarray analysis in Tourette Syndrome Postmortem Putamen*, 225 Journal of Neurological Science 57 (2004).

Dr. Huq then summarized literature detailing the effects of inflammation on various facets of the brain. Certain studies, for example, had evaluated the effects of immune mediators on the striatum, an area of the brain associated with tics. Huq First Rep. at 15. And there was also the possibility of long-term changes initiated in the brain after experiencing inflammation. *Id*. at 17. Several studies, Dr. Huq observed, had revealed decreases in synaptic plasticity as a result of brain inflammation generally, and specific effects from pro-inflammatory cytokines like IL-6, TNF, and IL-1β. *Id*. at 17-18; A. Mancini et al., *Neuro-Immune Cross-Talk in the Striatum: From Basal Ganglia Physiology to Circuit Dysfunction*, 12 Frontiers in Immunology 1 (2021), filed as Ex. 71 (ECF No. 36-5); R. Khairova et al., *A Potential Role for Pro-Inflammatory Cytokines in Regulating Synaptic Plasticity in Major Depressive Disorder*, 12 International Journal of Neuropsychopharmacology 561 (2009), filed as Ex. 61 (ECF No. 34-24).

As an alternative mechanistic explanation for how the pneumococcal vaccine could cause a tic disorder, Dr. Huq also proposed vaccine-driven molecular mimicry. Huq First Rep. at 18. He acknowledged he could point to no direct evidence showing molecular mimicry between the vaccine's antigenic components and the human brain, but referenced studies that suggested a possible cross-reaction between the wild *Streptococcus pneumoniae* bacterium and oxidized low-density lipoproteins. *Id*. at 18; *see* C. Binder et al., *Pneumococcal Vaccination Decreases Atherosclerotic Lesion Formation; Molecular Mimicry Between Streptococcus Pneumoniae and Oxidized LDL*, 9 Nature Medicine 736 (2003), filed as Ex. 26 (ECF No. 32-7) ("Binder"). Another evaluated the impact of vaccination itself on LDLs, revealing the existence of certain antibodies produced thereby. H. Grievink et al., *The Effect of a 13-Valent Conjugate Pneumococcal Vaccine on Circulating Antibodies Against Oxidized LDL and Phosphorylcholine in Man, a Randomized Placebo-Controlled Clinical Trial*, 9 Biology 345 (2020), filed as Ex. 46 (ECF No. 34-9) ("Grievink").

One study discussed in Dr. Huq's report utilized an experimental animal model for multiple sclerosis, and showed that "autoantibodies in MS target a phosphate group in phosphatidylserine and oxidized phosphatidylcholine derivatives"—thus suggesting the capacity of the pneumococcal vaccine to do the same in this context. Huq First Rep. at 19–20; P. Ho et al., *Identification of Naturally Occurring Fatty Acids of the Myelin Sheath That Resolve Neuroinflammation*, 4 Science Translational Medicine 137 (2012), filed as Ex. 53 (ECF No. 34-16) ("Ho"). Such research demonstrated "the likelihood of molecular mimicry between phosphoglycerol groups of Streptococcus pneumoniae capsular polysaccharide in Prevnar 13 vaccine and the phosphate group in phosphatidylserine and oxidized phosphatidylcholine derivatives component of the phospholipids in neurons or myelin." Huq First Rep. at 20. Exposure to the vaccine could possibly stimulate the production of cross-reactive antibodies

capable of causing neuronal harm of some kinds (even if articles like Ho were not specific to tic disorders).

Dr. Huq's supplemental report largely restated his prior two theories, citing the same literature. Huq Second Rep. at 1-3. He did offer the additional observation, however, that G.T.'s normal MRI results did not, in his opinion, preclude the existence of brain inflammation or an immune-mediated process sufficient to have caused a tic disorder, citing two studies showing that patients with inflammatory brain disease can have normal MRIs. *Id*. at 3–4; T. Cellucci et al., *Clinical Approach to the Diagnosis of Autoimmune Encephalitis in the Pediatric Patient*, 7 Neurology, Neuroimmunology & Neuroinflammation 663 (2020), filed as Ex. 111 (ECF No. 44-4); Y. Hacohen et al., *Paediatric Autoimmune Encephalopathies: Clinical Features, Laboratory Investigations and Outcomes in Patients With or Without Antibodies to Known Central Nervous System Autoantigens*, 84 Journal of Neurology, Neurosurgery and Psychiatry 748 (2013), filed as Ex. 113 (ECF No. 44-6).

2. Dr. M. Eric Gershwin

Dr. Gershwin is a Distinguished Professor of Medicine in the Division of Rheumatology/Allergy and Clinical Immunology at the University of California Davis School of Medicine. Gershwin CV, filed as Ex. 119 (ECF No. 48-2). He previously served as the Chief of the same division for nearly twenty years. *Id*. He received his medical degree from Stanford University, and completed his residency at Tufts-New England Medical Center. *Id.* He is certified by the American Board of Internal Medicine in Rheumatology, and by the American Board of Allergy and Clinical Immunology. *Id*. at 2. He serves as an editor for several autoimmunity and allergy journals, and has co-authored over a thousand articles. *Id.* at 13–101. He holds an active medical license in California. *Id*. at 2.

Dr. Gershwin's report was, unfortunately, not particularly helpful in the resolution of this matter. Most of the six pages of his opinion features block quotes from two studies or Dr. Huq's first report. See Gershwin Rep. at 2-6. Both studies cited are literature reviews evaluating available research on the relationship between immune mechanisms and Tourette syndrome. D. Martino et al., *The Role of Immune Mechanisms in Tourette Syndrome*, 1617 Brain Research 126 (2015), filed as Ex. 120 (ECF No. 48-3); C. Hsu et al., *Immunological Dysfunction in Tourette Syndrome and Related Disorders*, 22 International Journal of Molecular Science 853 (2021), filed as Ex. 121 (ECF No. 48-4).

Beyond the above, Dr. Gershwin has offered little in the way of firsthand analysis useful in understanding Petitioner's theory of causation. At bottom, he has opined that a 4th dose of the pneumococcal vaccine allows for the possibility of a rapid rise in antibodies (given the immune system's prior familiarity with the vaccine) and a quicker cell-mediated response. Rep. at 6. Relying on Dr. Huq's report, Dr. Gershwin proposes that vaccine upregulation of cytokines will result in a breach of the blood-brain barrier, leading to Tourette's syndrome. *Id.* Otherwise, Dr. Gershwin "defer[s] to Dr. Huq" on the specific mechanism for this process. *Id.*

B. *Respondent's Experts*

Respondent submitted two expert reports in this case: one by Dr. Lawrence Brown, and another by Dr. Andrew MacGinnitie. Brown Report, dated October 17, 2022, filed as Ex. A (ECF No. 40-1) ("Brown Rep."); MacGinnitie Report, dated October 27, 2022, filed as Ex. C (ECF No. 40-3) ("MacGinnitie Rep.").

1. Dr. Lawrence Brown

Dr. Brown is an academic child neurologist, with a special focus on sleep medicine. Brown Rep. at 1. He has over 40 years of experience managing children with neurological diseases, including thousands with Tourette syndrome, tic disorders and related neuropsychiatric conditions. *Id*. He received his medical degree from the New York University School of Medicine, and completed residencies and fellowships at The Children's Hospital of Philadelphia. Brown CV, filed as Ex. B (ECF No. 40-2). He is an Emeritus Associate Professor of Neurology and Pediatrics at the University of Pennsylvania School of Medicine. Brown CV at 1. He holds board certifications in pediatrics, pediatric neurology, and sleep medicine. Id. He has authored numerous journal articles, book chapters, and reviews. *Id*. at 7–11. He holds an active medical license in Pennsylvania. *Id.* at 2.

Based on review of the medical record, Dr. Brown opined that while G.T.'s Tourette syndrome symptoms likely developed around the time he received the fourth pneumococcal vaccine dose in January 2019, "there is no scientific support that would suggest that this is anything but an unrelated coincidence." Rep. at 7. In advancing this opinion, Dr. Brown commented both on Petitioner's theory generally, as well as the evidence offered to support it.

First, Dr. Brown criticized Dr. Huq's causation theories, deeming them to be "based entirely on tenuous and unproven hypothetical connections." Brown Rep. at 5. He began with Dr. Huq's contention that cytokine-induced brain inflammation could act as the mechanism for development of Tourette syndrome. *Id*. at 6. Although he acknowledged that pro-inflammatory cytokines can affect the areas of the brain in the manner Dr. Huq specifies, there is no medical or scientific support for the concept that this drives Tourette syndrome specifically. *Id*. He also dismissed Dr. Huq's molecular mimicry theory, noting that the only literature support offered for it was a study regarding the wild *S. pneumoniae* bacterium, and which was performed on mouse samples rather than on humans. *Id*. Otherwise, Dr. Brown contended, there exists no direct evidence that harm to the human brain can be instigated by a pneumococcal vaccine via molecular mimicry. *Id.*

Second, Dr. Brown criticized Dr. Huq's focus on epilepsy or seizure disorders in proposing how a vaccine might also cause Tourette syndrome. Brown Rep. at 5. He noted that G.T.'s physicians never made a diagnosis of epilepsy or seizures, even if it was reasonably suspected in the beginning of his clinical course. *Id*. And while there were electrographic abnormalities observed from his EEG testing, no correlation between his electrical activity and motor symptoms was found. *Id.* Thus, in Dr. Brown's view "the theoretic discussion of the role of inflammation in epilepsy bears no relation to the issues in this patient." *Id*. at 6.

Dr. Brown also contended that medical literature does not generally support a connection between vaccines and pediatric autoimmune neurologic disorders, and certainly not via the proposed mechanisms herein. Brown Rep. at 6. At most, it has been hypothesized that molecular mimicry might constitute the mechanism behind regional *narcolepsy* epidemics after administration of the Pandemrix flu vaccines in 2009-10, but similar associations have not been made with other forms of the flu vaccine—or pneumococcal vaccine for that matter. *Id*. at 6–7. Indeed, the only database review performed on neuropsychiatric disorders after childhood vaccination used a database from 2002-07, before the availability of the pneumococcal vaccine. *Id*. D. Leslie et al., *Temporal Association of Certain neuropsychiatric Disorders Following Vaccination of Children and Adolescents: A Pilot Case-Control*, 8 Frontiers in Psychiatry 3 (2017), filed as Ex. A, Tab 9 (ECF No. 46-9). And even then, there was only a slight, post-vaccination increase found in neuropsychiatric disorders such as tics, ADHD, OCD, and anxiety disorders. *Id*. at 5. No other subsequent research of which Dr. Brown was aware has shown a connection between the pneumococcal vaccine and tics, or any other neuropsychiatric disorder. *Id*. at 5, 7.

Although Dr. Brown acknowledged that there is limited research into the biologic mechanisms most likely resulting in Tourette syndrome, in his view G.T.'s personal medical history contained many factors more likely contributory than vaccination. Brown Rep. at 4–5. For example, G.T. has an uncle with tics, autism, and schizophrenia, suggesting there may be a family-associated genetic susceptibility for neuropsychiatric disorders. *Id.* at 4. And genetic testing performed on G.T. identified a "variant of unknown significance" in the histidine decarboxylase gene, which has been connected in studies to the development of Tourette syndrome. *Id.*; A. Ercan-Senicek et al., *L-histidine Decarboxylase and Tourette's Syndrome*, 362 New England Journal of Medicine 1901 (2010), filed as Ex. 38 (ECF NO. 34-1) ("Ercan-Senicek").

2. Dr. Andrew MacGinnitie

Dr. Andrew MacGinnitie was (at the time of his report)[6] the Clinical Chief for the Division of Immunology at Boston Children's Hospital, directing clinical operations for Allergy/Immunology, Rheumatology and Dermatology. MacGinnitie Rep. at 1. He is also an Associate Professor of Pediatrics at Harvard Medical School. *Id*.; CV of Andrew J. MacGinnitie, dated October 27, 2022, filed as Ex. D (ECF No. 40-4). He received his medical degree from the University of Chicago Pritzker School of Medicine, graduating with both an M.D. and a Ph.D. from the Department of Pathology. *Id.* He completed a residency in Pediatrics in the Boston Combined Residency Program, training at Boston Children's Hospital and Boston Medical Center, followed by an Allergy/Immunology fellowship at Boston Children's Hospital. *Id.* at 2. He maintains an active clinical practice, and has extensive experience in caring for children and adults with a variety of immunologic diseases, including reactions to vaccines. Id. Dr. MacGinnitie is board certified in both Allergy/Immunology and Pediatrics, and is a Fellow of the

[6] Dr. MacGinnitie has since joined Children's Wisconsin as a pediatric allergy immunology specialist and Chief Professor in Pediatrics. Get to know Andrew MacGinnitie, MD from Allergy Immunology, *Children's Wisconsin* https://childrenswi.org/medical-professionals/latest-news/andrew-macginnitie-md (last accessed April 18, 2024).

American Academy of Allergy, Asthma and Immunology. Id. Additionally, he performs research and has published articles in several areas related to Immunology, including proposed vaccine reactions and primary immunodeficiency. Id.

Dr. MacGinnitie took issue with both alternative mechanistic aspects of Dr. Huq's theories offered to explain how the pneumococcal vaccine could cause Tourette syndrome. First, he contended that Dr. Huq had presented no evidence that the vaccine can likely induce brain inflammation as a general matter. MacGinnitie Rep. at 8. The same was true of Dr. Huq's assertion that cytokines could cross the blood-brain barrier. *Id*. In fact, Dr. MacGinnitie observed that one of Dr. Huq's cited sources actually stated that "cytokines as such *cannot cross the blood-brain barrier*, a least under physiologic conditions." Z. Kronfol & D. Remick, *Cytokines and the Brain: Implications for Clinical Psychiatry*, 157 American Journal of Psychiatry 683, 686 (2000), filed as Ex. 64 (ECF No. 34-27) (emphasis added).

Dr. Huq had similarly failed to substantiate the portion of his theory maintaining that the pneumococcal polysaccharides found in the pneumococcal vaccine can trigger immune activation. MacGinnitie Rep. at 8. None of the studies Dr. Huq cited involved human, or even animal, experiments, but instead relied wholly on findings specific to incubated cell cultures. *Id*. See, for example, E. Arva & B. Andersson, *Induction of Phagocyte-Stimualting Cytokines by In vitro Stimulation of Human Peripheral Blood Mononuclear Cells with Haemophilus Influenzae*, 49 Scandinavian Journal of Immunology 411 (1999), filed as Ex. 22 (ECF No. 32-3). Further, the studies cited relied on pneumococcal bacteria and polysaccharides in much higher doses than what is contained in the Prevnar vaccine, and thus did not accurately reflect the actual concentration of these substances that would be found in the bloodstream. *Id*.

Dr. MacGinnitie also criticized Dr. Huq's molecular mimicry-based theory. MacGinnitie Rep. at 10. In particular, he noted problems with several items of independent literature offered in support of the theory. Binder, for example, obtained its findings through use of a mix pneumococcal extracts and complete Freund's adjuvant—something used solely in an experimental context and never in human vaccines, as it causes severe inflammation. *Id.* at 11; Binder at 737. Grievink, by contrast, did evaluate the effects of the pneumococcal vaccine, and yet expressly concluded that "no increase in…anti-phosphorylcholine or anti-oxLDL antibodies was observed" after vaccination—rendering it unsupportive of Dr. Huq's theory. *Id.*; Grievink at 1.

Dr. MacGinnitie further called into question Ho, which Dr. Huq had stated "suggest[s] the likelihood of molecular mimicry between phosphoglycerol groups of *Streptococcus pneumoniae* capsular polysaccharide in [the] Prevnar 13 vaccine and the phosphate group phosphatidylserine and oxidized phosphatidylcholine derivatives component of the phospholipids in neurons or myelin." MacGinnitie Rep. at 11 (*citing* Huq First Rep. at 20). As Dr. MacGinnitie explained, phosphate is one of the most abundant elements in the body, found in multiple components of all cells. MacGinnitie Rep. at 11. Phospholipids specifically are one of the two major components of a cell membrane. *Id*. at 12. Were phosphate-containing molecules or phospholipids a likely target of molecular-mimicry induced attack, generalized autoimmunity would be occurring throughout the body—and not simply at the situs of brain

or other central nervous system tissues where a tic disorder might be arguably instigated. *Id*. Ho also demonstrated that although antibodies induced by the vaccine recognize some phospholipids, this is not consistently the case, as the antibodies did not react with several phospholipid-containing lipoproteins, thereby establishing that "the presence of a phosphate molecule may be necessary but is clearly not sufficient for targeting by these antibodies." *Id*. at 13; Ho at 9–14. And Ho's focus was not even tic disorders, but multiple sclerosis, a distinguishable condition. MacGinnitie Rep. at 14.

Dr. MacGinnitie challenged Dr. Huq's argument that the aluminum-based adjuvant contained in the pneumococcal vaccine could function as a blood-brain barrier neurotoxin. MacGinnitie Rep. at 9. As he noted, the articles Dr. Huq cited for this proposition had relied on aluminum doses far higher than the amount contained in the pneumococcal vaccine. *Id*. In fact, even higher levels of aluminum are found in common foods or environmentally, meaning the comparatively small amount contained in the vaccine to which a person might be exposed was far less likely to be toxic in the manner proposed by Dr. Huq. *Id.*

Dr. Huq's causation theories, Dr. MacGinnitie added, were not corroborated by G.T.'s medical history. First, G.T. never displayed any evidence of systemic inflammation. MacGinnitie Rep. at 8. He did not display symptoms like fever, lethargy, or increased sleeping, which would be expected in the presence of post-vaccine systemic inflammation. *Id*. Further, the timing of G.T.'s onset of symptoms was inconsistent with a molecular mimicry process as driving a tic disorder like Tourette syndrome. *Id*. at 10. The adaptive immune mechanisms that must occur for a molecular mimicry-driven, cross-reactive autoimmune process would take roughly one week to occur, as evidenced by studies on myocarditis or Guillain-Barre Syndrome ("GBS"), diseases reasonably understood to be mediated by molecular mimicry between foreign antigens and self structures. *Id*.; D. McFarlin, *Immunological Parameters in Guillain-Barre Syndrome*, 27 Annals of Neurology 25 (1990), filed as Ex. C, Tab 11 (ECF No. 46-21). Myocarditis, for example, would manifest within two to three weeks of an infection. J. Carapetis et al., *Acute Rheumatic Fever and Rheumatic Heart Disease*, 2 Nature Reviews Disease Primers 15084 (2016), filed as Ex. C, Tab 8 (ECF No. 46-18). As a result, G.T.'s rapid onset of symptoms after vaccination (with Petitioner maintaining onset of tics was evident as early as the day after vaccination) was inconsistent with molecular mimicry as driving the disease process. *Id.*

III. Procedural History

This claim was initiated in December 2020. After going through "pre-assignment review" (a process used by the Office of Special Masters to ensure that the most important documents and records relating to a claim have been filed), the Petition was activated and assigned to my docket. Respondent filed his Rule 4(c) Report in December 2021, and I ordered Petitioner to file an expert report in support of the claim. This report was filed in April 2022. Respondent then filed their two responsive expert reports in October 2022. This was followed by two additional expert reports from Petitioner, in January and April of 2023. I then set a schedule for a Ruling on the Record, to be completed in September 2023. The matter is now fully briefed and ripe for resolution.

IV. Parties' Arguments

A. *Respondent*

Respondent argues as a threshold matter that G.T.'s alleged seizure and encephalopathy diagnoses are unfounded. Mot. at 12. While an initial neurologist that saw G.T. noted "static encephalopathy," no further mention of encephalopathy is made in later treatment notes. G.T. saw numerous specialists after this visit, none of whom diagnosed encephalopathy or seizures. Respondent thus proposes that G.T.'s diagnosis of Tourette syndrome, as reflected in the record to have been the diagnosis of other treaters, is correct. *Id*. at 13.

Respondent then addresses the three prongs for causation claims as established by the Federal Circuit in *Althen v. Sec'y of Health & Hum. Servs.*, 418 F.3d 1274 (Fed. Cir. 2005). He first argues that that Petitioner has not presented any reliable evidence for a causal relationship between the pneumococcal vaccine and Tourette Syndrome, criticizing the expert reports filed by Petitioner. Respondent dismisses Dr. Gershwin's report entirely, as it is mainly comprised of block quotes and does not present any causal theory, and therefore deserves little weight. Mot. at 15. Dr. Huq's reports include no epidemiological studies connecting the pneumococcal vaccine with tic disorders—and in fact he admits none exist. *Id*.; see Ex. 18 at 8. The studies Dr. Huq does cite for various facets of his theory are inapplicable for a number of reasons—some use only animal or cell models, for example, while others rely on entirely different vaccines or study different conditions. *Id*. at 15–19. And the cytokine-based theory Dr. Huq puts forth has been rejected in numerous other Program decisions. *Id*. at 24.

Respondent next maintains that Petitioner has failed to show a logical sequence of cause and effect for G.T.'s injury under *Althen* Prong Two. Mot. at 21. Although Dr. Huq proposes a theory that G.T. suffered cytokine-induce brain inflammation, there is no evidence that G.T. actually experienced any systemic inflammation. *Id*. Further, evidence more strongly supports a genetic basis for G.T.'s tic disorder—he has an uncle with multiple neuropsychiatric disorders (including tics), and has a "variant of uncertain significance ("UVS")" on the histidine decarboxylase gene, which has been connected to Tourette syndrome. *Id*. at 22; see also Brown Report at 4.

Finally, with respect to the timing prong, Respondent highlights Dr. MacGinnitie's report, which argued that G.T.'s symptoms onset occurred much faster than illnesses likely thought to be caused by molecular mimicry. Mot. at 23. For example, illnesses such as myocarditis after Group A strep infection only onset 2-3 weeks after infection. *Id*. In contrast, G.T. began to have abnormal movements as soon as the same day he received his vaccine, making his clinical course inconsistent with the adaptive immune response involved in molecular mimicry. And Dr. Huq's reports do not establish any medical timeframe for his cytokine-induced brain inflammation theory. *Id*. at 24.

B. *Petitioner*

Petitioner makes some effort to contest Respondent's argument that G.T. was not diagnosed with seizures or encephalopathy. Opp. at 9. She cites treater notes from initial visits, stating G.T. was "positive

for seizures" and that the "encounter diagnosis" was "abnormal involuntary movements." *Id.* at 9. She also highlights her own observations of "rapid blinking and 'zoning out,'" starting two days after vaccination. These notes, along with G.T.'s abnormal EEG results, prove a diagnosis of seizures beyond a preponderance of the evidence in her view. *Id*. at 10. But at the same time, she summarizes the evidence supporting G.T.'s Tourette Syndrome/tic disorder diagnosis (and it does not appear Respondent disagrees with at least that diagnosis). *Id.* at 10–11.

In Petitioner's view, Drs. Huq and Gershwin together have established a reputable causation theory in their reports, satisfying *Althen* Prong One. Opp. at 12. The brain inflammation theory Dr. Huq has provided, along with the medical literature he cites, establishes a mechanism by which Prevnar-13 triggers the development of tic disorders. *Id*. at 12–13, 15–16. Petitioner contests Respondent's criticism of Dr. Gershwin's report, defending his use of block quotes from Dr. Huq's report and journal articles. *Id*. at 14. She also characterizes Respondent's attempts to discredit Dr. Gershwin's report and Petitioner's overall argument as demanding conclusive proof of their theory, thus improperly raising her overall burden of proof in this case. *Id*.

Petitioner also maintains the "did cause" element is met, disputing Respondent's contention that G.T. did not display signs of systemic inflammation. Opp. at 16. On the contrary, she argues, the redness and swelling at his injection site, along with his involuntary movements, are evidence of systemic inflammation. *Id*. at 18. She similarly rejects Respondent's argument that G.T.'s genetic mutation was a more likely contributor to his development of a tic disorder, citing treater notes from the relevant test stating that this variation is found in multiple individuals and cannot entirely explain his clinical presentation. *Id*. at 18; Ex. 10 at 10. And she reiterates Dr. Huq's brain inflammation theory, adding that she is not obligated to prove any *Althen* element to a degree of scientific certainty. *Id*. at 18.

Petitioner concludes by contending that the third, timeframe prong is satisfied, deeming the onset of G.T.'s symptoms to be consistent with the proposed mechanism of cytokine-induced brain inflammation, as argued by Dr. Huq. Opp. at 19; First Huq Rep. at 22. She also references other cases in which cytokine-based theories have been found persuasive. Opp. at 19.

V. Applicable Law

A. *Standards for Vaccine Claims*

To receive compensation in the Vaccine Program, a petitioner must prove either: (1) that he suffered a "Table Injury"—i.e., an injury falling within the Vaccine Injury Table—corresponding to one of the vaccinations in question within a statutorily prescribed period of time or, in the alternative, (2) that his illnesses were actually caused by a vaccine (a "Non-Table Injury"). *See* Sections 13(a)(1)(A), 11(c)(1), and 14(a), as amended by 42 C.F.R. § 100.3; § 11(c)(1)(C)(ii)(I); *see also Moberly v. Sec'y of Health & Hum. Servs.*, 592 F.3d 1315, 1321 (Fed. Cir. 2010); *Capizzano v. Sec'y of Health & Hum. Servs.*, 440 F.3d 1317, 1320 (Fed. Cir. 2006).[7] Petitioners allege a causation-in-fact claim (and could not

[7] Decisions of special masters (some of which I reference in this ruling) constitute persuasive but not binding authority. *Hanlon v. Sec'y of Health & Hum. Servs.*, 40 Fed. Cl. 625, 630 (1998). By contrast, Federal Circuit rulings concerning legal issues

otherwise allege a Table claim of encephalopathy or encephalitis after receipt of the flu vaccine: there is no such claim).

For both Table and Non-Table claims, Vaccine Program petitioners bear a "preponderance of the evidence" burden of proof. Section 13(1)(a). That is, a petitioner must offer evidence that leads the "trier of fact to believe that the existence of a fact is more probable than its nonexistence before [he] may find in favor of the party who has the burden to persuade the judge of the fact's existence." *Moberly*, 592 F.3d at 1322 n.2; *see also Snowbank Enter. v. United States*, 6 Cl. Ct. 476, 486 (1984) (mere conjecture or speculation is insufficient under a preponderance standard). Proof of medical certainty is not required. *Bunting v. Sec'y of Health & Hum. Servs.*, 931 F.2d 867, 873 (Fed. Cir. 1991). In particular, a petitioner must demonstrate that the vaccine was "not only [the] but-for cause of the injury but also a substantial factor in bringing about the injury." *Moberly*, 592 F.3d at 1321 (quoting *Shyface v. Sec'y of Health & Hum. Servs.*, 165 F.3d 1344, 1352–53 (Fed. Cir. 1999)); *Pafford v. Sec'y of Health & Hum. Servs*., 451 F.3d 1352, 1355 (Fed. Cir. 2006). A petitioner may not receive a Vaccine Program award based solely on his assertions; rather, the petition must be supported by either medical records or by the opinion of a competent physician. Section 13(a)(1).

In attempting to establish entitlement to a Vaccine Program award of compensation for a Non-Table claim, a petitioner must satisfy all three of the elements established by the Federal Circuit in *Althen*, 418 F.3d at 1278: "(1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of proximate temporal relationship between vaccination and injury."

Each of the *Althen* prongs requires a different showing. Under *Althen* prong one, petitioners must provide a "reputable medical theory," demonstrating that the vaccine received *can cause* the type of injury alleged. *Pafford*, 451 F.3d at 1355–56 (citations omitted). To satisfy this prong, a petitioner's theory must be based on a "sound and reliable medical or scientific explanation." *Knudsen v. Sec'y of Health & Hum. Servs.*, 35 F.3d 543, 548 (Fed. Cir. 1994). Such a theory must only be "legally probable, not medically or scientifically certain." *Knudsen,* 35 F.3d at 549.

Petitioners may satisfy the first *Althen* prong without resort to medical literature, epidemiological studies, demonstration of a specific mechanism, or a generally accepted medical theory. *Andreu v. Sec'y of Health & Hum. Servs.*, 569 F.3d 1367, 1378–79 (Fed. Cir. 2009) (citing *Capizzano*, 440 F.3d at 1325–26). Special masters, despite their expertise, are not empowered by statute to conclusively resolve what are essentially thorny scientific and medical questions, and thus scientific evidence offered to establish *Althen* prong one is viewed "not through the lens of the laboratorian, but instead from the vantage point of the Vaccine Act's preponderant evidence standard." *Id.* at 1380. Accordingly, special masters must take care not to increase the burden placed on petitioners in offering a scientific theory linking vaccine to injury. *Contreras*, 121 Fed. Cl. at 245.

are binding on special masters. *Guillory v. Sec'y of Health & Hum. Servs.*, 59 Fed. Cl. 121, 124 (2003), *aff'd* 104 F. Appx. 712 (Fed. Cir. 2004); *see also Spooner v. Sec'y of Health & Hum. Servs.*, No. 13-159V, 2014 WL 504728, at *7 n.12 (Fed. Cl. Spec. Mstr. Jan. 16, 2014).

In discussing the evidentiary standard applicable to the first *Althen* prong, the Federal Circuit has consistently rejected the contention that it can be satisfied merely by establishing the proposed causal theory's scientific or medical *plausibility*. *See Boatmon v. Sec'y of Health & Hum. Servs.*, 941 F.3d 1351, 1359 (Fed. Cir. 2019); *LaLonde v. Sec'y of Health & Hum. Servs.*, 746 F.3d 1334, 1339 (Fed. Cir. 2014) ("[h]owever, in the past we have made clear that simply identifying a 'plausible' theory of causation is insufficient for a petitioner to meet her burden of proof" (citing *Moberly*, 592 F.3d at 1322)); *see also Howard v. Sec'y of Health & Hum. Servs*., 2023 WL 4117370, at *4 (Fed. Cl. May 18, 2023) ("[t]he standard has been preponderance for nearly four decades"), *appeal docketed,* No. 23-1816 (Fed. Cir. Apr. 28, 2023). And petitioners always have the ultimate burden of establishing their *overall* Vaccine Act claim with preponderant evidence. *W.C. v. Sec'y of Health & Hum. Servs.*, 704 F.3d 1352, 1356 (Fed. Cir. 2013) (citations omitted); *Tarsell v. United States*, 133 Fed. Cl. 782, 793 (2017) (noting that *Moberly* "addresses the petitioner's overall burden of proving causation-in-fact under the Vaccine Act" by a preponderance standard).

The second *Althen* prong requires proof of a logical sequence of cause and effect, usually supported by facts derived from a petitioner's medical records. *Althen*, 418 F.3d at 1278; *Andreu*, 569 F.3d at 1375–77; *Capizzano*, 440 F.3d at 1326; *Grant v. Sec'y of Health & Hum. Servs.*, 956 F.2d 1144, 1148 (Fed. Cir. 1992). In establishing that a vaccine "did cause" injury, the opinions and views of the injured party's treating physicians are entitled to some weight. *Andreu*, 569 F.3d at 1367; *Capizzano*, 440 F.3d at 1326 ("medical records and medical opinion testimony are favored in vaccine cases, as treating physicians are likely to be in the best position to determine whether a 'logical sequence of cause and effect show[s] that the vaccination was the reason for the injury'") (quoting *Althen*, 418 F.3d at 1280). Medical records are generally viewed as particularly trustworthy evidence, since they are created contemporaneously with the treatment of the patient. *Cucuras v. Sec'y of Health & Hum. Servs.*, 993 F.2d 1525, 1528 (Fed. Cir. 1993).

Medical records and statements of a treating physician, however, do not *per se* bind the special master to adopt the conclusions of such an individual, even if they must be considered and carefully evaluated. Section 13(b)(1) (providing that "[a]ny such diagnosis, conclusion, judgment, test result, report, or summary shall not be binding on the special master or court"); *Snyder v. Sec'y of Health & Hum. Servs*., 88 Fed. Cl. 706, 746 n.67 (2009) ("there is nothing . . . that mandates that the testimony of a treating physician is sacrosanct—that it must be accepted in its entirety and cannot be rebutted"). As with expert testimony offered to establish a theory of causation, the opinions or diagnoses of treating physicians are only as trustworthy as the reasonableness of their suppositions or bases. The views of treating physicians should be weighed against other, contrary evidence also present in the record—including conflicting opinions among such individuals. *Hibbard v. Sec'y of Health & Hum. Servs.*, 100 Fed. Cl. 742, 749 (2011) (not arbitrary or capricious for special master to weigh competing treating physicians' conclusions against each other), *aff'd*, 698 F.3d 1355 (Fed. Cir. 2012); *Veryzer v. Sec'y of Dept. of Health & Hum. Servs.*, No. 06-522V, 2011 WL 1935813, at *17 (Fed. Cl. Spec. Mstr. Apr. 29, 2011), *mot. for review denied,* 100 Fed. Cl. 344, 356 (2011), *aff'd without opinion*, 475 F. Appx. 765 (Fed. Cir. 2012).

The third *Althen* prong requires establishing a "proximate temporal relationship" between the vaccination and the injury alleged. *Althen*, 418 F.3d at 1281. That term has been equated to the phrase "medically-acceptable temporal relationship." *Id.* A petitioner must offer "preponderant proof that the onset of symptoms occurred within a timeframe which, given the medical understanding of the disorder's etiology, it is medically acceptable to infer causation." *de Bazan v. Sec'y of Health & Hum. Servs.*, 539 F.3d 1347, 1352 (Fed. Cir. 2008). The explanation for what is a medically acceptable timeframe must align with the theory of how the relevant vaccine can cause an injury (*Althen* prong one's requirement). *Id.* at 1352; *Shapiro v. Sec'y of Health & Hum. Servs.*, 101 Fed. Cl. 532, 542 (2011), *recons. denied after remand*, 105 Fed. Cl. 353 (2012), *aff'd mem.*, 503 F. Appx. 952 (Fed. Cir. 2013); *Koehn v. Sec'y of Health & Hum. Servs.*, No. 11-355V, 2013 WL 3214877 (Fed. Cl. Spec. Mstr. May 30, 2013), *mot. for review denied,* (Fed. Cl. Dec. 3, 2013), *aff'd*, 773 F.3d 1239 (Fed. Cir. 2014).

B. *Law Governing Analysis of Fact Evidence*

The process for making determinations in Vaccine Program cases regarding factual issues begins with consideration of the medical records. Section 11(c)(2). The special master is required to consider "all [] relevant medical and scientific evidence contained in the record," including "any diagnosis, conclusion, medical judgment, or autopsy or coroner's report which is contained in the record regarding the nature, causation, and aggravation of the petitioner's illness, disability, injury, condition, or death," as well as the "results of any diagnostic or evaluative test which are contained in the record and the summaries and conclusions." Section 13(b)(1)(A). The special master is then required to weigh the evidence presented, including contemporaneous medical records and testimony. *See Burns v. Sec'y of Health & Hum. Servs*., 3 F.3d 415, 417 (Fed. Cir. 1993) (determining that it is within the special master's discretion to determine whether to afford greater weight to contemporaneous medical records than to other evidence, such as oral testimony surrounding the events in question that was given at a later date, provided that such determination is evidenced by a rational determination).

As noted by the Federal Circuit, "[m]edical records, in general, warrant consideration as trustworthy evidence." *Cucuras*, 993 F.2d at 1528; *Doe/70 v. Sec'y of Health & Hum. Servs.*, 95 Fed. Cl. 598, 608 (2010) ("[g]iven the inconsistencies between petitioner's testimony and his contemporaneous medical records, the special master's decision to rely on petitioner's medical records was rational and consistent with applicable law"), *aff'd*, *Rickett v. Sec'y of Health & Hum. Servs*., 468 F. App'x 952 (Fed. Cir. 2011) (non-precedential opinion). A series of linked propositions explains why such records deserve some weight: (i) sick people visit medical professionals; (ii) sick people attempt to honestly report their health problems to those professionals; and (iii) medical professionals record what they are told or observe when examining their patients in as accurate a manner as possible, so that they are aware of enough relevant facts to make appropriate treatment decisions. *Sanchez v. Sec'y of Health & Hum. Servs.*, No. 11–685V, 2013 WL 1880825, at *2 (Fed. Cl. Spec. Mstr. Apr. 10, 2013); *Cucuras v. Sec'y of Health & Hum. Servs.*, 26 Cl. Ct. 537, 543 (1992), *aff'd*, 993 F.2d 1525 (Fed. Cir. 1993) ("[i]t strains reason to conclude that petitioners would fail to accurately report the onset of their daughter's symptoms").

Accordingly, if the medical records are clear, consistent, and complete, then they should be

afforded substantial weight. *Lowrie v. Sec'y of Health & Hum. Servs*., No. 03–1585V, 2005 WL 6117475, at *20 (Fed. Cl. Spec. Mstr. Dec. 12, 2005). Indeed, contemporaneous medical records are often found to be deserving of greater evidentiary weight than oral testimony—especially where such testimony conflicts with the record evidence. *Cucuras*, 993 F.2d at 1528; *see also Murphy v. Sec'y of Health & Hum. Servs*., 23 Cl. Ct. 726, 733 (1991), *aff'd per curiam*, 968 F.2d 1226 (Fed. Cir. 1992), *cert. denied*, *Murphy v. Sullivan*, 506 U.S. 974 (1992) (citing *United States v. United States Gypsum Co.*, 333 U.S. 364, 396 (1947) ("[i]t has generally been held that oral testimony which is in conflict with contemporaneous documents is entitled to little evidentiary weight.")).

However, the Federal Circuit has also noted that there is no formal "presumption" that records are accurate or superior on their face to other forms of evidence. *Kirby v. Sec'y of Health & Hum. Servs.,* 997 F.3d 1378, 1383 (Fed. Cir. 2021). There are certainly situations in which compelling oral testimony may be more persuasive than written records, such as where records are deemed to be incomplete or inaccurate. *Campbell v. Sec'y of Health & Hum. Servs*., 69 Fed. Cl. 775, 779 (2006) ("like any norm based upon common sense and experience, this rule should not be treated as an absolute and must yield where the factual predicates for its application are weak or lacking"); *Lowrie*, 2005 WL 6117475, at *19 ("[w]ritten records which are, themselves, inconsistent, should be accorded less deference than those which are internally consistent") (quoting *Murphy*, 23 Cl. Ct. at 733)). Ultimately, a determination regarding a witness's credibility is needed when determining the weight that such testimony should be afforded. *Andreu*, 569 F.3d at 1379; *Bradley v. Sec'y of Health & Hum. Servs*., 991 F.2d 1570, 1575 (Fed. Cir. 1993).

When witness testimony is offered to overcome the presumption of accuracy afforded to contemporaneous medical records, such testimony must be "consistent, clear, cogent, and compelling." *Sanchez*, 2013 WL 1880825, at *3 (citing *Blutstein v. Sec'y of Health & Hum. Servs*., No. 90–2808V, 1998 WL 408611, at *5 (Fed. Cl. Spec. Mstr. June 30, 1998)). In determining the accuracy and completeness of medical records, the Court of Federal Claims has listed four possible explanations for inconsistencies between contemporaneously created medical records and later testimony: (1) a person's failure to recount to the medical professional everything that happened during the relevant time period; (2) the medical professional's failure to document everything reported to her or him; (3) a person's faulty recollection of the events when presenting testimony; or (4) a person's purposeful recounting of symptoms that did not exist. *La Londe v. Sec'y of Health & Hum. Servs*., 110 Fed. Cl. 184, 203–04 (2013), *aff'd*, 746 F.3d 1334 (Fed. Cir. 2014). In making a determination regarding whether to afford greater weight to contemporaneous medical records or other evidence, such as testimony at hearing, there must be evidence that this decision was the result of a rational determination. *Burns*, 3 F.3d at 417.

C. *Analysis of Expert Testimony*

Establishing a sound and reliable medical theory often requires a petitioner to present expert testimony in support of his claim. *Lampe v. Sec'y of Health & Hum. Servs*., 219 F.3d 1357, 1361 (Fed. Cir. 2000). Vaccine Program expert testimony is usually evaluated according to the factors for analyzing scientific reliability set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 594–96

(1993). *See Cedillo v. Sec'y of Health & Hum. Servs.*, 617 F.3d 1328, 1339 (Fed. Cir. 2010) (citing *Terran v. Sec'y of Health & Hum. Servs.*, 195 F.3d 1302, 1316 (Fed. Cir. 1999)). "The *Daubert* factors for analyzing the reliability of testimony are: (1) whether a theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) whether there is a known or potential rate of error and whether there are standards for controlling the error; and (4) whether the theory or technique enjoys general acceptance within a relevant scientific community." *Terran*, 195 F.3d at 1316 n.2 (citing *Daubert*, 509 U.S. at 592–95).

The *Daubert* factors play a slightly different role in Vaccine Program cases than they do when applied in other federal judicial fora (such as the district courts). *Daubert* factors are usually employed by judges (in the performance of their evidentiary gatekeeper roles) to exclude evidence that is unreliable and/or could confuse a jury. In Vaccine Program cases, by contrast, these factors are used in the *weighing* of the reliability of scientific evidence proffered. *Davis v. Sec'y of Health & Hum. Servs*., 94 Fed. Cl. 53, 66–67 (2010) ("uniquely in this Circuit, the *Daubert* factors have been employed also as an acceptable evidentiary-gauging tool with respect to persuasiveness of expert testimony already admitted"). The flexible use of the *Daubert* factors to evaluate the persuasiveness and reliability of expert testimony has routinely been upheld. *See e.g.*, *Snyder*, 88 Fed. Cl. at 742–45. In this matter (as in numerous other Vaccine Program cases), *Daubert* has not been employed at the threshold, to determine what evidence should be admitted, but instead to determine whether expert testimony offered is reliable and/or persuasive.

Respondent frequently offers one or more experts of his own in order to rebut a petitioner's case. Where both sides offer expert testimony, a special master's decision may be "based on the credibility of the experts and the relative persuasiveness of their competing theories." *Broekelschen v. Sec'y of Health & Hum. Servs.*, 618 F.3d 1339, 1347 (Fed. Cir. 2010) (citing *Lampe*, 219 F.3d at 1362). However, nothing requires the acceptance of an expert's conclusion "connected to existing data only by the *ipse dixit* of the expert," especially if "there is simply too great an analytical gap between the data and the opinion proffered." *Snyder*, 88 Fed. Cl. at 743 (quoting *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997)); *see also Isaac v. Sec'y of Health & Hum. Servs*., No. 08-601V, 2012 WL 3609993, at *17 (Fed. Cl. Spec. Mstr. July 30, 2012), *mot. for rev. denied*, 108 Fed. Cl. 743 (2013), *aff'd*, 540 F. Appx. 999 (Fed. Cir. 2013) (citing *Cedillo*, 617 F.3d at 1339). Weighing the relative persuasiveness of competing expert testimony, based on a particular expert's credibility, is part of the overall reliability analysis to which special masters must subject expert testimony in Vaccine Program cases. *Moberly*, 592 F.3d at 1325–26 ("[a]ssessments as to the reliability of expert testimony often turn on credibility determinations"); *see also Porter v. Sec'y of Health & Hum. Servs*., 663 F.3d 1242, 1250 (Fed. Cir. 2011) ("this court has unambiguously explained that special masters are expected to consider the credibility of expert witnesses in evaluating petitions for compensation under the Vaccine Act").

Expert opinions based on unsupported facts may be given relatively little weight. *See Dobrydnev v. Sec'y of Health & Hum. Servs.*, 556 F. Appx. 976, 992–93 (Fed. Cir. 2014) ("[a] doctor's conclusion is only as good as the facts upon which it is based") (citing *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209, 242 (1993) ("[w]hen an expert assumes facts that are not supported by a

preponderance of the evidence, a finder of fact may properly reject the expert's opinion")). Expert opinions that fail to address or are at odds with contemporaneous medical records may therefore be less persuasive than those which correspond to such records. *See Gerami v. Sec'y of Health & Hum. Servs.*, No. 12-442V, 2013 WL 5998109, at *4 (Fed. Cl. Spec. Mstr. Oct. 11, 2013), *aff'd*, 127 Fed. Cl. 299 (2014).

D. *Consideration of Medical Literature*

Both parties filed numerous items of medical and scientific literature in this case, but not every filed item factors into the outcome of this Decision. While I have reviewed all the medical literature submitted in this case, I discuss only those articles that are most relevant to my determination and/or are central to Petitioner's case—just as I have not exhaustively discussed every individual medical record filed. *Moriarty v. Sec'y of Health & Hum. Servs.*, 844 F.3d 1322, 1328 (Fed. Cir. 2016) ("[w]e generally presume that a special master considered the relevant record evidence even though he does not explicitly reference such evidence in his decision") (citation omitted); *see also Paterek v. Sec'y of Health & Hum. Servs.,* 527 F. Appx. 875, 884 (Fed. Cir. 2013) ("[f]inding certain information not relevant does not lead to—and likely undermines—the conclusion that it was not considered").

E. *Standards for Ruling on the Record*

I am resolving Petitioner's claim on the filed record. The Vaccine Act and Rules not only contemplate but encourage special masters to decide petitions on the papers where (in the exercise of their discretion) they conclude that doing so will properly and fairly resolve the case. Section 12(d)(2)(D); Vaccine Rule 8(d). The decision to rule on the record in lieu of hearing has been affirmed on appeal. *Kreizenbeck v. Sec'y of Health & Hum. Servs*., 945 F.3d 1362, 1366 (Fed. Cir. 2020); *see also Hooker v. Sec'y of Health & Hum. Servs*., No. 02-472V, 2016 WL 3456435, at *21 n.19 (Fed. Cl. Spec. Mstr. May 19, 2016) (citing numerous cases where special masters decided case on the papers in lieu of hearing and that decision was upheld). I am simply not required to hold a hearing in every matter, no matter the preferences of the parties. *Hovey v. Sec'y of Health & Hum. Servs*., 38 Fed. Cl. 397, 402–03 (1997) (determining that special master acted within his discretion in denying evidentiary hearing); *Burns*, 3 F.3d at 417; *Murphy v. Sec'y of Health & Hum. Servs.*, No. 90-882V, 1991 WL 71500, at *2 (Fed. Cl. Spec. Mstr. Apr. 19, 1991).

ANALYSIS

I. Overview of Tourette Syndrome and Program treatment

In this case, although Petitioner makes some effort to defend a possible seizure order diagnosis, the record best supports Tourette syndrome as explanatory of G.T.'s symptoms—as the parties at least tacitly agree. Mot. at 12 (citing Respondent's pediatric neurology expert, Dr. Brown, as opining that

"G.T. fulfills the minimal criteria for Tourette syndrome""); *see also* Huq First Rep. at 7 ("[o]ne can say that [G.T.] is at increased risk of developing seizures, but no diagnosis of seizures or epilepsy can be made"). I shall accordingly treat Tourette syndrome as the injury to be analyzed herein.

Tourette syndrome is a childhood-onset neuropsychiatric disorder characterized by chronic motor and vocal tics. Cheng at 1. The disorder often occurs concurrently with other common neuropsychiatric disorders, such as obsessive-compulsive disorder and attention deficit-hyperactivity disorder. Ercan-Senicek at 1. Tourette syndrome typically improves in adulthood. *Id*. Although its cause is unknown, there is strong support for a genetic component. Cheng at 1. Various environmental factors have also been hypothesized, including an autoimmune response after infection. *Id.* The molecular mechanisms of the disorder are also uncertain, although "multiple lines of evidence suggest involvement of dopaminergic neurotransmission and abnormalities involving cortical-striatal-thalamic-cortical circuitry." Ercan-Senicek at 1.

A few cases alleging Tourette syndrome was caused by a vaccine have been brought in the Program—but none have resulted in a favorable entitlement finding. *See,* e.g., *Reape v. Sec'y of Health & Hum. Servs.*, No. 15-1146V, 2017 WL 1246325 (Fed. Cl. Spec. Mstr. Mar. 3, 2017) (Tourette syndrome after Flumist vaccine); *Duncan v. Sec'y of Dep't of Health & Hum. Servs.*, No. 00-183V, 2002 WL 368598 (Fed. Cl. Spec. Mstr. Feb. 15, 2002) (Tourette syndrome after DTaP vaccine). Additional unsuccessful Tourette claims have been combined with claims for PAN/PANDAS as a vaccine injury. *See Castaneda v. Sec'y of Health & Hum. Servs.*, No. 15-1066V, 2020 WL 3833076 (Fed. Cl. Spec. Mstr. May 18, 2020) (PANS/Tourette syndrome after receipt of Pentacel, MMR, Hepatitis A, and pneumococcal vaccines), *mot. for review den'd*, 152 Fed. Cl. 576 (2020); *Heath v. Sec'y of Health & Hum. Servs.*, No. 19-0749V, 2020 WL 1486840 (Fed. Cl. Spec. Mstr. Feb. 19, 2020) (PANS/autoimmune encephalitis after Tdap vaccine).

II. Petitioner Has Not Established Causation

Petitioner has not carried her burden of proof to show causation-in-fact. In particular, she cannot meet the first two prongs of the *Althen* test.[8]

First, Petitioner has not demonstrated a reliable theory explaining how the pneumococcal vaccine "can cause" Tourette syndrome, with neither of the mechanistic explanations offered by Dr. Huq preponderantly established. Dr. Huq forthrightly acknowledged he could marshal no direct evidence connecting the pneumococcal vaccine to the alleged injury (*see,* e.g., Huq First Rep. at 8)—and of course Vaccine Program claimants are *never* so obligated. But his efforts to link a chain of circumstantial proof into a reliable causal theory were nevertheless unsuccessful.

[8] Because the first two prongs are not met, I do not discuss Petitioner's *Althen* Prong Three showing—since its success would not save the claim. *Zumwalt v. Sec'y of Health & Hum. Servs.*, No. 16-994V, 2019 WL 1953739, at n.21 (Fed. Cl. Spec. Mstr. Mar. 21, 2019), *mot. for review den'd*, 146 Fed. Cl. 525 (2019).

For example, the contention that cytokine-driven inflammation attributable to vaccination could produce a neurologic injury leading to a tic disorder relied too much on the *expected* impact of vaccination (which inherently causes some limited cytokine upregulation) to become pathologic—but without a comparable showing that cytokines actually *drive* Tourette syndrome. *Zumwalt v. Sec'y of Health & Hum. Servs.*, No. 16-994V, 2019 WL 1953739, at *18 (Fed. Cl. Mar. 21, 2019) ("[t]he fact that vaccines are known to stimulate cytokine production (in part due in some cases to the inclusion of an adjuvant) does not amount to a reliable causation theory that such stimulation is necessarily disease-causing"), *mot. for review den'd,* 146 Fed. Cl. 525 (2019). Even if cytokine elevation can be seen *in connection* with a tic disorder later, this does not mean the cytokines caused this process to begin—let alone that any vaccine could upregulate cytokines to sufficient levels to be dangerous in this manner. And the explanation offered for how the cytokines would traverse the blood brain barrier (to reach the neurologic brain tissues where (presumably) they would spark damaging inflammation) relied on the circular reasoning that the same increased inflammatory impact of vaccination would *both* penetrate the barrier and then harm the brain, but again without first demonstrating critical aspects of the theory about the vaccine's capacity to cause this level of inflammation in the first place.[9]

Dr. Huq's molecular mimicry-based theory was even less well-substantiated. I have now too many times noted that invocation of the theory—which is itself scientifically reliable, and which can explain how *other* vaccines might provoke an autoimmune disease process with respect to *other* illnesses—does not satisfy a claimant's first prong burden, without some corroborative reliable evidence to show why the theory "works" in the context of the alleged injury and vaccine. *McKown v. Sec'y of Health & Hum. Servs.*, No. 15-1451, 2019 WL 4072113, *50 (Fed. Cl. Spec. Mstr. July 15, 2019) ("[M]erely chanting the words 'molecular mimicry' in a Vaccine Act case does not render a causation theory scientifically reliable, absent additional evidence specifically tying the mechanism to the injury and/or the vaccine in question.").

I have also previously analyzed in several cases whether the pneumococcal vaccine could, via molecular mimicry, cause different forms of neurologic injury, such as GBS—but have rejected arguments parallel to what Dr. Huq puts forward in this matter. *See,* e.g., *Trollinger v. Sec'y of Health & Hum. Servs.*, No. 16-473V, 2023 WL 2521912 (Fed. Cl. Feb. 17, 2023) (rejecting molecular mimicry theory that pneumococcal vaccine caused GBS), *mot. for review den'd*, 167 Fed. Cl. 127 (2023); *Bielak v. Sec'y of Health & Hum. Servs.*, No. 18-761V, 2023 WL 35509, at *34 (Fed. Cl. Spec. Mstr. Jan. 3, 2023) (rejecting theory that pneumococcal vaccine caused GBS). In such prior cases, I have noted that (a) there was a lack of credible evidence that the wild bacterial infectious counterpart for the vaccine was associated with the alleged injury, (b) it was not adequately demonstrated that phospholipid structures in

[9] Dr. Huq's side proposal that the aluminum adjuvant contained in the vaccine acts as a blood-brain barrier neurotoxin is dangerously close to the "Adjuvant Induction of Autoimmune Disease," or "ASIA" theory, which has been widely rejected in the Program. *See e.g.*, *D'Angiolini v. Sec'y of Health & Human Servs.*, No. 99-578V, 2014 WL 1678145 (Fed. Cl. Spec. Mstr. Mar. 27, 2014) (determining that the ASIA theory did not meet the minimum threshold for reliability and thus could not be a reliable basis for compensation), *mot. for review den'd*, 122 Fed.Cl. 86 (July 2, 2015), *aff'd*, 645 Fed.Appx. 1002 (Fed. Cir. 2016); *Rowan v. Sec'y of Health & Human Servs.*, No. 10-272V, 2014 WL 7465661 (Fed. Cl. Spec. Mstr. Dec. 8, 2014) (rejecting the ASIA theory, as it is not a proven theory and the mechanism whereby adjuvants could cause autoimmune illness is not known), *mot. for review den'd*, 2015 WL 3562409 (Fed. Cl. June 9, 2015).

the vaccine might cross-react pathologically with comparable structures in the nerve myelin, or that (c) an antibody-driven disease process (which would have to be the main impact of molecular mimicry between vaccine antigens and self structures) even explained how the disease actually began or developed. *Trollinger,* 2023 WL 2521912, at *28 (discussion of gaps in antibody-driven disease process theory).

Here, Dr. Huq offers nothing that would suggest these kinds of rejected theories have more probative value in the context of Tourette syndrome. In fact, it is not even agreed that Tourette syndrome *is* autoimmune in character. And he references articles like Ho—which (albeit in the context of GBS) I have extensively reviewed but found wanting. *Trollinger,* 2023 WL 2521912, at *17 (discussion of issues in citing the Ho study); *Bielak*, 2023 WL 35509, at *34 (discussing inapplicability of Ho study to Petitioner's causal theory). At best, Dr. Huq references articles like Binder or Grievink—but neither offer strong support for his theories. Grievink, for example, specifically sought to evaluate the extent to which the pneumococcal vaccine was protective against a wholly-distinguishable condition, atherosclerosis. Grievink at 2. And its observations about the production of certain antibodies in response to a wild *S. pneumoniae* infection (and in fact their protective value, in comparison to the vaccine) cannot be persuasively extended to a finding suggesting that the antibodies are likely disease-causing *in the context of this case.* Binder similarly is limited in scope; it too relates to atherosclerosis, not Tourette syndrome, and its experimental findings about molecular mimicry (as the mechanism by which the wild bacterial infection could induce the production of *beneficial* autoantibodies) simply do not make it more likely than the vaccine (which Binder did not test) would induce *pathologic* autoantibodies.

At bottom, although Dr. Huq had the proper qualifications needed to opine on causation, his overall opinion was too spotty, with large gaps in the chain of reasoning, to deem it preponderantly-established. But the opinions offered by Drs. Brown and MacGinnitie (reflecting the input of an individual with neurologic treatment expertise comparable to Dr. Huq, *plus* an immunologic expert) persuasively established why it is unlikely that the pneumococcal vaccine could cause a tic disorder like Tourette syndrome, rebutting Dr. Huq's arguments while offering other reasons to doubt the theory's scientific and medical reliability.

Second, the record does not preponderantly support the conclusion that the pneumococcal vaccine had more than a temporal relationship to the onset of G.T.'s tics, and thus did not likely cause his injury (regardless of whether the vaccine "can cause" Tourette syndrome). There is no evidence that G.T. was experiencing excessive or unanticipatedly-high amounts of generalized inflammation post-vaccination (nor did he experience this with any of the three prior doses). MacGinnitie Rep. at 8; Ex. 6 at 14, 35, and 72. None of the indicia of vaccine-associated malaise (fever or lethargy, for example) were evident—there is only the close-in-time onset of the tics themselves. But a theory assuming a cytokine-driven process should show some clinical signs of cytokine-oriented inflammation associated with vaccination.

In addition, treater support for a vaccine causal relationship is not found in this record. By contrast, treaters did seem to connect G.T.'s symptoms (when thought to reflect PANDAs) to prior strep infections. Ex. 12 at 13. Later treaters expressed doubt, however, that a tic disorder itself could be

infectious in origin (reducing the likelihood that a vaccination, which mimics infection in a more limited and controlled manner, could be causal). Ex. 15 at 43–44 (Dr. Taub 2020 neurologic assessment). And although G.T.'s treaters provided him with a medical exemption from vaccines for a year, the record indicates that this was due to Petitioner's personal desire for the exemption rather than any reasoned treater concerns. Ex. 12 at 13 ("[m]other need[s] exemption from the vaccine, to provide letter for school enrollment").

CONCLUSION

Having reviewed the medical records, expert reports, medical literature, and the parties' respective arguments, I do not find that Petitioner has met her preponderant burden of proof. Accordingly, she has not established entitlement to an award of damages, and I must **DISMISS** the claim. In the absence of a motion for review filed pursuant to RCFC Appendix B, the Clerk of the Court SHALL ENTER JUDGMENT in accordance with the terms of this Decision.[10]

IT IS SO ORDERED.

s/Brian H. Corcoran
Brian H. Corcoran
Chief Special Master

[10] Pursuant to Vaccine Rule 11(a), the parties may expedite entry of judgment by filing a joint notice renouncing their right to seek review.